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1. Bi - Monthly Progress Report.

Period: December 1, 1972 to January 31, 1973.

A. TITLE OF INVESTIGATION : Land Use, Forest Density, Soil Mapping, Erosion,

Drainage, Salinity Limitations

ERTS-A Proposal Number : 053

B. PRINCIPAL INVESTIGATOR: N.J. Yassoglou

Number : FO 375

C. During this reporting period 70 mm negative and positive transparencies and 9.5 inch positive transparencies and prints were received covering the Eastern Coast of Greece and Thrace. In addition to the photographic images two digital tapes covering the Eastern half of Peloponesse and the Athens-Delpi area were also received. However, important test sites located in the western half of the country were not covered by the imagery obtained so far.

D.   DISCUSSION OF THE RESULTS AND THE ACCOMPLISHMENTS.

D1. Analysis of the Photographic Imagery.

The 9.5 inch RBV positive transparencies of the eastern coastal area of Greece were studied with the aid of a magnifying viewer.

Ten land use classes were recognized and mapped as shown in the annexed maps.

The recognized classes were the following:

(1) Well irrigated agricultural crops. (orchards and annual crops)

(2) Marginally irrigated agricultural crops (vineyards, olive trees, orchards, and annual crops).

(3) Non irrigated agricultural crops, (olive groves, vineyards,annual crops)

(4) Non irrigated winter crops and bare soil.

(5) Fir and Austrian Pine Forests.

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(6) Dense Halepo Pine Forest.

(7) Thin Halepo Pine Forest and shrubs.

(8) Dense .deciduous forests

(9) Thin deciduous forests, shrubs, scattered, olive trees, or other trees.

(10) Shrubs, sparcely covered wild land and urban areas.

The best RBV band for gray level mapping of land use classes was band 2.False

color images were prepared of two frames for each of the three RBV channels.

By supermposing these images,well irrigated and healthy citrus plantations

could be separated from the marginally irrigated and nutrient defficient

citrus plantations on large scale. This separation was based on the

brightness of the false infrared color.

The 9.5 inch RBV transparencies were used in correcting the boundaries of a

1:1000.000 Soil map of Greece. This map is being prepared in a common effort

of the european countries under the auspices of FAO (United Nations)for the

contruction of the soil map of Europe.

The ERTS imagery provided a more accurate estimate of the areas and the

boundaries of the soils which have been developed on the quarternary and

recent aluvial deposits.

D2. Analysis of Digital Imagery.

Digital MSS data from two frames were analysed at LARS using the facilities

which that Laboratory provides for analysis of multispectral data. The two

frames which were used are : a) Eastern Peloponnese ERTS E-1010 -08375

                                        b) Delphi Athens ERTS-1010-08373

Two types of analysis products were taken for interpretation:

D2. 1 Photographs from the LARS Digital Display

Black and white photographs were taken of several selected areas in various channels and various magnifications using the LARS Digital Display. These pictures provide better distinguishable features of land use than the RBV or MSS photographic image. For example Athens area was identified clearly as a resedential area in the Digital Display pictures but not in the RBV images. Airports, streets, parks and squares are shown on the various magnifications of the digital display.

D.2.2. Classification maps.

Two test sites from each frame were classified using the LARS computer programs LARSPLAY and LARSYSAA. For the KOPAIS area where detailed ground truth was available.The following nine classes were distinguished.

a) corn

b) Alfalfa

c) cotton

d) wheat

e) eroded soil

f) cultivated bare soil

g) trees

h) shrubs

i) water ways

The classification results were displayed on the Computer Line Printer using alphanumeric symbols and on the Digital Display from where false color photographs were taken,thus the results are available in the two forms:Computer Line printer maps and false color pictures. These results were satisfactory.

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For the other three sites because of lack of ground truth, a first approxi-
mation the following land features have been recognized:

a) Two classes of sea water. Probably related to depth.

b) Roads

c) Residential areas

d) Forests

e) Soil

f) Airports

g) Shrubs and wast land

h) Agricultural land.

The analysis products which were obtained are now being interpreted. On a

first approximation it can be stated that the classification map was quite

accurate, which prooves that ERTS data can be used for the numerical classi-

fication of land use features.

E. SIGNIFICANCE OF THE RESULTS

The results of the analyses which have been performed on the obtained data show

that it is possible to obtain information of practical significance as fol-

lows.

E.1. Agriculture

A quick and accurate estimate of the proper use of the valuable land can be

made on the basis of temporal and spectral characteristics of the land

features. The study of the Kopais Plain is a good example of this achievement.

The agricultural potential of the plain is high ,provided that irrigated agri-

culture is practiced. The ERTS-A data showed that in 1972 about one third of

the area was cultivated by wheat, a suboptimal and non irrigated crop.

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The photographic images have been proved to be an important tool for the general and on a large scale assement of the citrus sites in eastern Peloponnese. The delineation of dry farm land was satisfactory. The separation of the different crops has been so far only fair due to lack of adequate ground truth and the high proportion of bare soil.

E. 2 Forestry

A rather accurate delineation of the major forest formations in the test areas was achieved on the basis of spatial and spectral characteristics of the studied areas.

The forest stands were separated into two density classes: a) dense forest and b) broken forest. No estimates of timber volume could be made. The bare idle land of the deforested and severely eroded mountain ranges were accurately separated.

On the basis of ERT-A data and of the existing ground truth information a rather accurate mapping of the major vegetational forms of the mountain ranges can be made.

E. 3 Soils

The ERTS-A data have provided information for the mapping of the following major soil formations:

a. Recent alluvial soils

b. Soil on quarternary deposits

c. Severely eroded soil and lithosol

d. Wet soils

The data were most useful for the correction of the 1:1000.000 soil map of Greece.

E.4 Estimation of Cost Benefits

An estimation of cost benefits cannot be made accurately at this stage of the investigation. However, a rough estimate of the ratio of the cost for

obtaining the same amount of information from ERTS-A data and from conventional operations would approximately be 1:6 to 1:10, in favor of the ERTS-A.

F. LISTING OF ARTICLES.

No articles have been published thus far.

G. RECOMMENDATIONS.

The coverage of western Greece would most probably produce additional data. An effort should be made by NASA for the documentation of existing computer programs for the analysis of digital data, so that all research groups equiped with various types of computers may use them.

H. CHANGES IN STANDING ORDER

No changes are requested.

K. APPENDIX

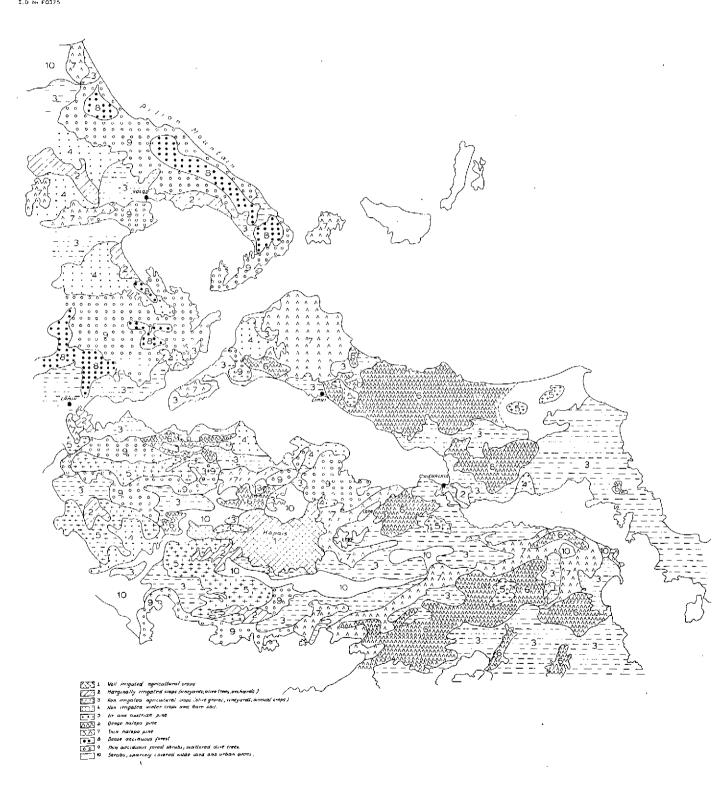## Operational Procedure for Constructing Classification Maps from Digital Data.

The procedure included the following steps.

a. Alphanumeric display of 10 gray level classes for 0.60-0.70 μ band.

b. Clustering which involved estimation of the separability of the gray level classes based on the calculation of the divergance between the classes. The clustering was used for finding training fields.

c. Statistical Calculations.

These included the following :

i. Calculation of radiance histograms for each class and channel

ii. Plotting of spectra for each class showing the mean radiance and the standard deviation at each channel.

iii. Calculation of the correlation matrix for the radiance of four channels per each class. The correlation coefficients were small thus all four channels were used for the classification of land features.

d. Classification and alphanumeric display of the classes. On the basis of the statistical data the computer was instructed to classify specific areas and print alphanumeric maps.-

LAND USE MAP OF CENTRAL GREECE

Legend:

1 Well irrigated agricultural crops
2 Marginally irrigated crops (vineyards, olive trees, orchards)
3 Non irrigated agricultural crops (olive groves, vineyards, annual crops)
4 Non irrigated winter crops and bare soil.
5 Fir and austrian pine
6 Dense halepo pine
7 Thin halepo pine
8 Dense deciduous forest
9 Thin deciduous forest shrubs, scattered olive trees.
10 Shrubs, sparsely covered arable land and urban areas.

SITE EVALUATION MAP
(CENTRAL GREECE)

PRINCIPAL INVESTIGATOR: N. YASSOGLOU
PROPOSAL No 053
   I.D.N. No FO375

▦	1	Well irrigated and wet agricultural lands
▦	2	Inadequately irrigated agricultural lands
▨	3	Highly productive forest and range sites
▨	4	Moderately productive forest and range sites
▤	5	Forest and range sites of low productivity
▩	6	Site under study

LAND USE MAP OF EASTERN PELOPONNESE , GREECE

PRINCIPAL INVESTIGATOR : N. YASSOGLOU

PROPOSAL No 053
I.O No F0375

LEGEND

1. Well irrigated agricultural crops.
2. Marginally irrigated crops (vineyards, olive trees, orchards)
3. Non irrigated agricultural crops (olive groves, vineyards, annual crops)
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